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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/692,666	10/24/2003	Junxing Shen	ARC-P128	9958

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EXAMINER	
THOMAS, MIA M	

ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/692,666	SHEN ET AL.	
	Examiner	Art Unit	
	Mia M. Thomas	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,11-13 and 16* is/are rejected.

7)☒ Claim(s) *5-10,14,15,17-20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 April 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 09 April 2009 has been entered.

Response to Amendment

2. This Office Action is responsive to applicant's request for continued examination. As such, applicant has amended claims 1 and 16. Claims 1 to 20 remain pending. A complete response to applicant's remarks is stated here below.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herley (US 20040264806 A1) in combination with Benn et al. (US 5734740 A), Pollard (US 2004/0028271 A1) and Nicolas (US 20020172417 A1).

Regarding Claim 1: (currently amended) Herley teaches a method for a processor to color match a first image and a second image, wherein a first region of the first image and a second

region of the second image overlap ("The composite signal generator described herein provides a system and method for automatically generating a composite image of a scene from a set of two or more images of the scene. The resulting composite image has reduced or eliminated areas of occlusion relative to the images in the set. The composite is generated by first aligning or registering the images." at paragraph [0059]) the method comprising:

Benn also teaches color matching a first image and a second image, wherein a first region of the first image and a second region of the second image overlap (Refer to Figure 5, wherein numeral S6 states "Divide digital image into sub-images");
generating a first histogram of the first region (Refer to Figure 5, numeral S5);
generating a second histogram of the second region (Refer to Figure 5, numeral S8);

Pollard teaches determining at least one parameter of an optoelectronic conversion function (OECF) ("The processing itself may be performed according to the steps outlined in the flow-chart of FIG. 7. These include a pre-processing stage 92, which may typically include correction of the OECF (opto-electronic conversion function) of the sensor and white-balancing to compensate for variations in illumination." at paragraph [0108]);

color matching the second image to the first image by applying the OECF with the at least one parameter to the second image ("Following the colour correction and de-mosaicing stage 94 described above, a subsequent post-processing stage 96 may include exposure correction (which can also be accomplished at the preprocessing stage) and transformation to a standard colour space such as RGB (as described in IEC 61966-2-1)." at paragraph [0108]).

Nicolas teaches determining corresponding pixel values from the first and the second histograms (Refer to paragraph [0033]; "Only pixels of the first set of pixels are used to generate the first and the second histogram.");

Alternatively, Nicolas teaches color matching the second image to the first image by applying a function with the at least one parameter to the second image ("The receiving means 302 can get notified or has capabilities to extract information from the video signal about the type of scene that has been imaged in order to set the appropriate range of color values of the image display apparatus 300. E.g. in the case of a football match the predetermined range of colors should match the colors of grass." at paragraph [0068]). Although Nicolas does not expressly teach an OECF, it is obvious to one of ordinary skill in the art that an OECF function was known in the prior art at the time of the invention. This claimed limitation would have been obvious because the skilled artisan could have easily substituted the OECF function for any algorithm or routine as taught by Nicolas and this would have yielded the same predictable results to the skilled artisan to obtain the color matching results of the first and second images.

All the claimed elements were known in the prior art and one skilled in the art could have combined the elements as taught by Herley in combination with Benn, Pollard, and Nicolas by known methods with no change in their respective functions, and the combination of those teachings would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

Herley Benn, Pollard, and Nicolas are combinable because they are in the same field of color image processing, specifically, color correction.

The suggestion/motivation for combining the teachings of Herley Benn, Pollard, and Nicolas would have been to classify pixels via histogram processing and based on that classification, color matching, determining whether the pixels belong to texture or to flat regions by comparing 2 histograms, one taking into account all the pixels with the color in the predetermined range of color values, the second one counting only these same pixels if their luminance value differs more than a given threshold form the luminance of their neighbor., at abstract Nicolas.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herley Benn, Pollard, and Nicolas to obtain the specified claimed elements of Claim 1.

Regarding Claim 2 (original): Herley teaches removing a percentage of the overlapping pixels with the greatest difference in brightness ("In general, histogram equalization can be used to stretch or compress the brightness of the pixels making up an image based on the overall distribution of pixel brightness levels in the image." at paragraph [0079])

Herley does not expressly recite removing a percentage of overlapping pixels with the greatest difference in brightness; however, the skilled artisan could have yielded the same predictable results with no change in the respective functions since this particular technique of histogram equalization is recognized as a part of the ordinary capabilities of one skilled in the art.

Regarding Claim 3: (original): Benn teaches said generating a first histogram comprises recording in a first plurality of pixel value bins a first plurality of numbers of pixels that have respective pixel values in the first region (Refer to Figure 4, numeral S5) and said generating a second histogram comprises recording in a second plurality of pixel value bins a second

plurality of numbers of pixels that have the respective pixel values in the second region (Refer to Figure 4, numeral S8).

Regarding Claim 4: (previously presented): Herley teaches determining corresponding pixel values from the first and the second histograms comprises generating a lookup table (LUT) storing a third plurality of numbers of pixels and their corresponding pixel values ("From this count, a cumulative distribution function is computed and normalized to a maximum value corresponding to the number of pixel brightness levels employed. The cumulative distribution function is then used as a lookup table to map from the original pixel brightness levels to final levels." at paragraph [0080]).

Regarding Claim 16 (currently amended): Herley teaches a method for a processor to color match a first image and a second image, wherein a first region of the first image and a second region of the second image overlap ("The composite signal generator described herein provides a system and method for automatically generating a composite image of a scene from a set of two or more images of the scene. The resulting composite image has reduced or eliminated areas of occlusion relative to the images in the set. The composite is generated by first aligning or registering the images." at paragraph [0059]) the method comprising:

removing a percentage of overlapping pixels with the greatest difference in brightness ("In general, histogram equalization can be used to stretch or compress the brightness of the pixels making up an image based on the overall distribution of pixel brightness levels in the image." at paragraph [0079]);

Benn teaches generating a first histogram of the first region and a second histogram of the second region after said removing (Refer to Figure 5, numeral S5);
Nicolas teaches histogram matching the first and the second histograms to determine corresponding pixel values from the first and the second histograms (Refer to paragraph [0033]; "Only pixels of the first set of pixels are used to generate the first and the second histogram.").

Pollard teaches minimizing a color matching error between the corresponding pixel values, wherein the color matching error is generated from an optoelectronic conversion function (OECF) ("The processing itself may be performed according to the steps outlined in the flow-chart of FIG. 7. These include a pre-processing stage 92, which may typically include correction of the OECF (opto-electronic conversion function) of the sensor and white-balancing to compensate for variations in illumination." at paragraph [0108]);

color matching the second image to the first image by applying the OECF to the second image ("Following the colour correction and de-mosaicing stage 94 described above, a subsequent post-processing stage 96 may include exposure correction (which can also be accomplished at the preprocessing stage) and transformation to a standard colour space such as RGB (as described in IEC 61966-2-1)." at paragraph [0108]).

Alternatively, Nicolas teaches color matching the second image to the first image by applying a function with the at least one parameter to the second image ("The receiving means 302 can get notified or has capabilities to extract information from the video signal about the type of scene that has been imaged in order to set the appropriate range of color values of the image display

apparatus 300. E.g. in the case of a football match the predetermined range of colors should match the colors of grass." at paragraph [0068]). Although Nicolas does not expressly teach an OECF, it is obvious to one of ordinary skill in the art that an OECF function was known in the prior art at the time of the invention. This claimed limitation would have been obvious because the skilled artisan could have easily substituted the OECF function for any algorithm or routine as taught by Nicolas and this would have yielded the same predictable results to the skilled artisan to obtain the color matching results of the first and second images.

Herley Benn, Pollard, and Nicolas are combinable because they are in the same field of color image processing, specifically, color correction.

All the claimed elements were known in the prior art and one skilled in the art could have combined the elements as taught by Herley in combination with Benn, Pollard, and Nicolas by known methods with no change in their respective functions, and the combination of those teachings would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

The suggestion/motivation for combining the teachings of Herley Benn, Pollard, and Nicolas would have been to classify pixels via histogram processing and based on that classification, color matching, determining whether the pixels belong to texture or to flat regions by comparing 2 histograms, one taking into account all the pixels with the color in the predetermined range of color values, the second one counting only these same pixels if their luminance value differs more than a given threshold form the luminance of their neighbor., at abstract Nicolas.

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Herley Benn, Pollard, and Nicolas to obtain the specified claimed elements of Claim 16.

5. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herley (US 20040264806 A1) in combination with Benn et al. (US 5734740 A), Pollard (US 2004/0028271 A1) and Nicolas (US 20020172417 A1) and further in view of Hasler "Modeling the Opto-Electronic Conversion Function (OECF) For Application in the Stitching of Panoramic Images, hereinafter referred to as Hasler- (MOASPI).

Regarding Claim 11: Herley in combination with Benn, Pollard, and Nicolas teach all the claimed elements as rejected above.

The combination of Herley, Benn, Pollard, and Nicolas does not expressly teach the OECF is defined as: $$S(x) = x + \frac{2}{\pi}\arctan\left(\frac{a\sin(\pi x)}{1 - a\cos(\pi x)}\right),$$ wherein S () is the OECF, x is a pixel value normalized to (0, 1), and a(epsilon)(-1,1) is a first color matching parameter

Hasler– (MOASPI) teaches the OECF is defined as: $$S(x) = x + \frac{2}{\pi}\arctan\left(\frac{a\sin(\pi x)}{1 - a\cos(\pi x)}\right),$$ wherein S() is the OECF, x is a pixel value normalized to (0,1), and a(epsilon)(-1,1) is a first color matching parameter (Refer to Equation 1, right column, section 3, "The OECF Model").

Herley, Benn, Pollard, Nicolas and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality.

At the time the invention was made, the skilled artisan could have defined the OECF function as recited above. All the claimed elements were known in the prior art at the time of the invention.

The suggestion/motivation to combine the teachings of Herley, Benn, Pollard, and Nicolas with Hasler would have been the OECF with these definitive elements can "deliver an optimal result in a least square error sense." (Hasler, abstract).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine the teachings of Herley, Benn, Pollard, and Nicolas with Hasler to obtain the specified claimed elements of Claim 11.

Regarding Claim 12 (original): Hasler– (MOASPI) teaches determining at least one parameter of an OECF comprises minimizing a color matching error defined as:

$$e = \sum_{x_1 \in R_1, x_2 \in R_2} \left\| x_1 - S^{-1}(\alpha S(x_2)) \right\|^2,$$

wherein e is the color matching error, x.sub.1 and x.sub.2 are corresponding pixel values in the first and the second regions, R.sub.1 and R.sub.2 are the first and the second regions, S( ) is the OECF, S( ).sup.-1 is the inverse OECF, and (tau) is a second color matching parameter (Refer to Equation 2d, left column, paragraph 2, section 4 "The Error Metric").

6. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Herley (US 20040264806 A1) in combination with Benn et al. (US 5734740 A), Pollard (US 2004/0028271 A1), Nicolas (US 20020172417 A1), Hasler "Modeling the Opto-Electronic Conversion Function (OECF) For Application in the Stitching of Panoramic Images, hereinafter referred to as Hasler-(MOASPI) and further in view of Press, "The Art of Scientific Computing, 10.1 Golden Search in One Dimension"-hereinafter referred to as Press.

Regarding Claim 13: (original): Herley in combination with Benn, Pollard, Nicolas and Hasler teach all the claimed elements as rejected above.
Herley in combination with Benn, Pollard, Nicolas and Hasler does not specifically teach minimizing a color matching error comprises performing a golden section search of the color matching error.

Press teaches minimizing a color matching error comprises performing a golden section search of the color matching error (For example, refer to equations (10.1.6) and (10.1.7) in reference to the golden mean or golden section search examples).

Herley, Benn, Pollard, Nicolas, Hasler and Press are combinable because they are in the same field of image segmenting in panoramic images and golden section searching.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to minimizing a color matching error comprises performing a golden section search of the color matching error.

The suggestion/motivation would have been "the golden section search guarantees that each new function evaluation will bracket minimum to an interval a precise number times the size of the preceding interval." (Hasler, page 399-400, last paragraph, final sentence).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Herley, Benn, Pollard, Nicolas, Hasler and Press to obtain the specified claimed elements of Claim 13.

Allowable Subject Matter

7. Claims 5-10, 14, 15 and 17-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

8. Applicant's arguments with respect to claims 1-4,11-13 and 16 as argued at pages 9-16 have been considered but are moot in view of the new ground(s) of rejection. See newly rejected claims above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is (571)270-1583. The examiner can normally be reached on Monday-Thursday 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh M. Mehta can be reached on 571-272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Andrew W Johns/
Primary Examiner, Art Unit 2624

Mia M Thomas
Examiner
Art Unit 2624